

III Congreso Latinoamericano Biorrefinerías

Assessment of concepts for wheat grain and straw based biorefineries

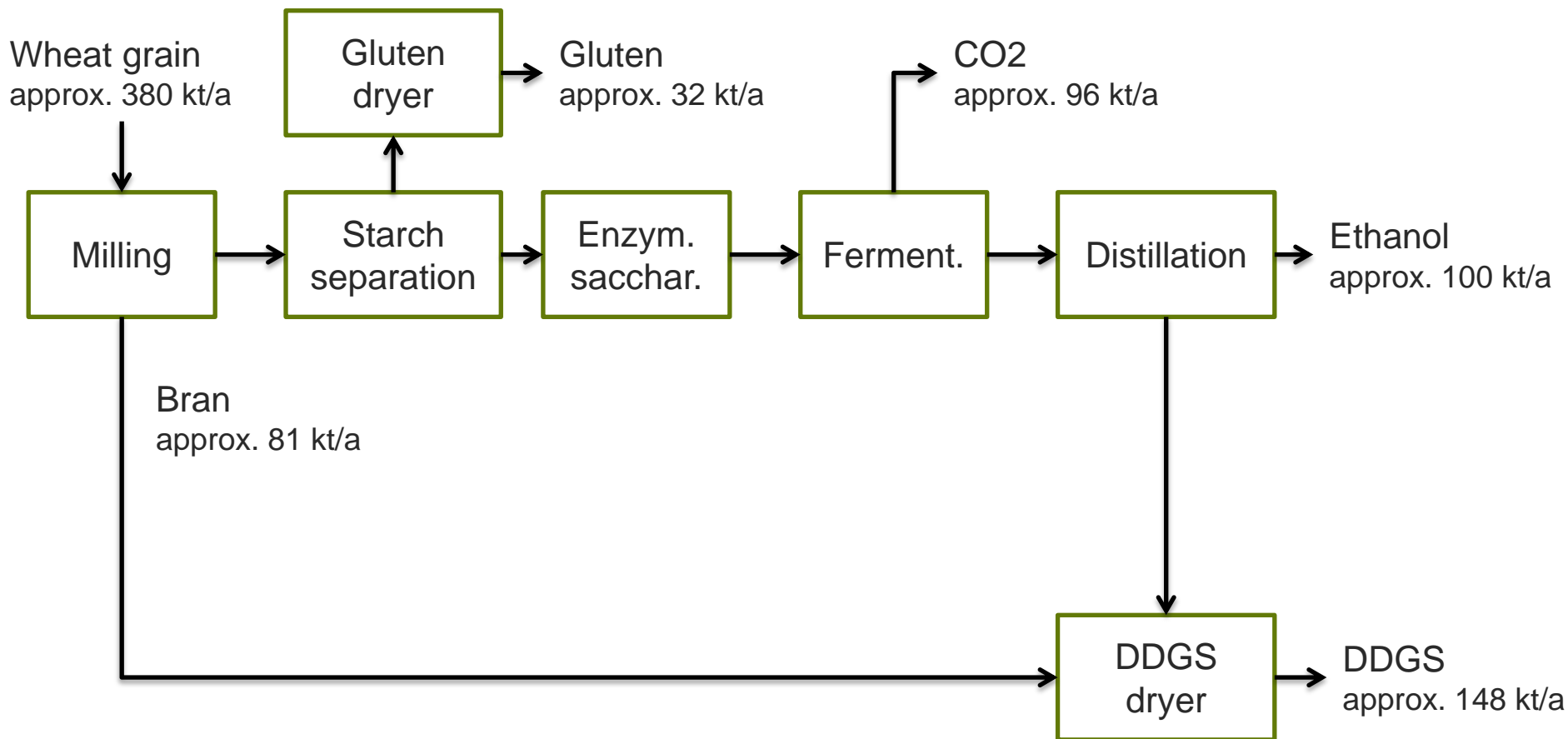


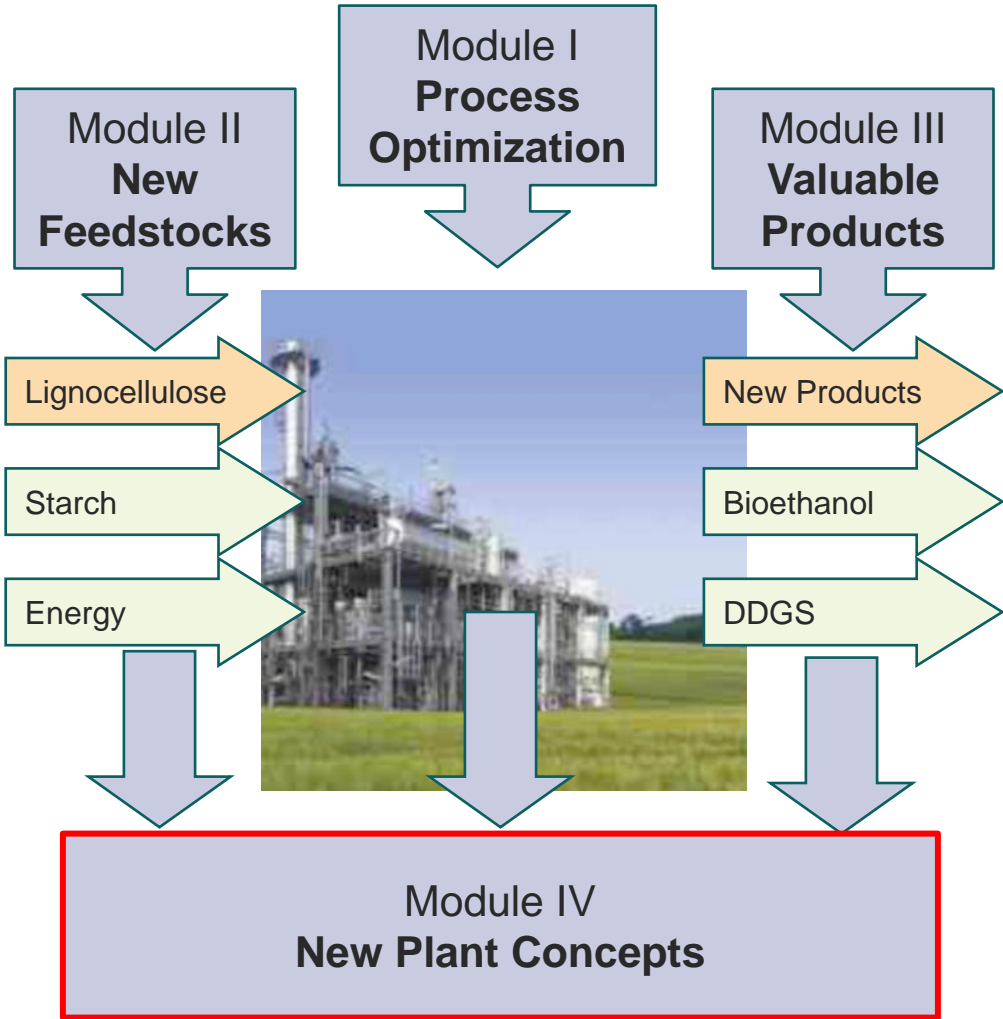
Arne Gröngroft

Pucón, November 19th, 2012

- Political aims: **ghg-mitigation**, rural development, diversification of energy sources...
- Ethanol produced from small grains (wheat) and sugar beet
- 7 plants in Germany producing fuel ethanol
- Thereof 4 running on grains and producing about 2/3 of German ethanol
- With increased production, sustainability issues became more visible
- Difficult market environment with high economic pressure because of expensive feedstock and sustainability regulations

- How can ethanol production be optimized, applying the biorefinery approach?
- How can 1st and 2nd generation ethanol be combined?
- How can this lead to synergies on behalf of economics and environmental impacts?





Collaborative research project

- 11 partner institutions

Industry



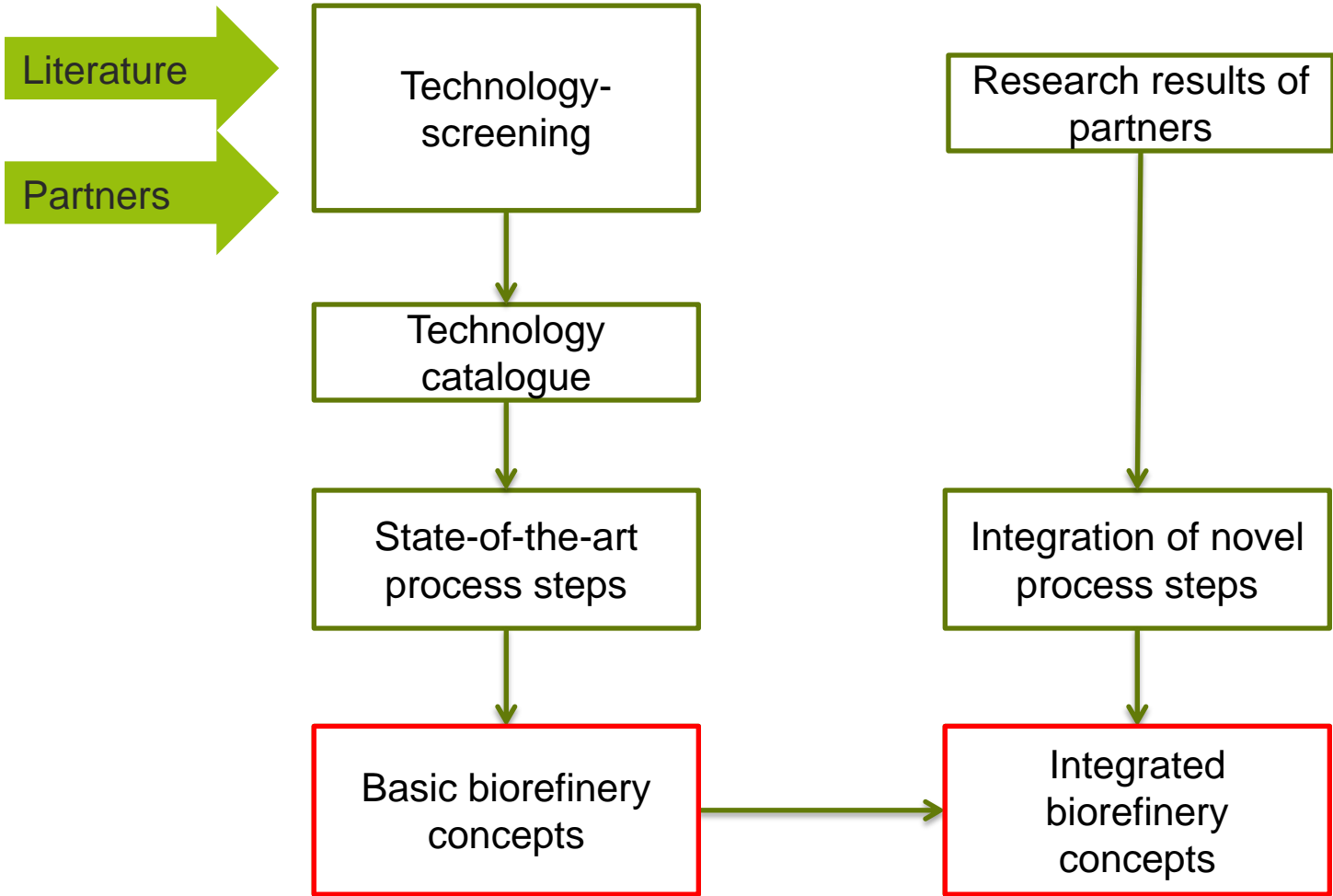
Research & Academia



- Funded by Federal Ministry for Education and Research
- Start: 08/2009 End: 12/2012



DEVELOPMENT OF PLANT CONCEPTS



wheat only Ref.

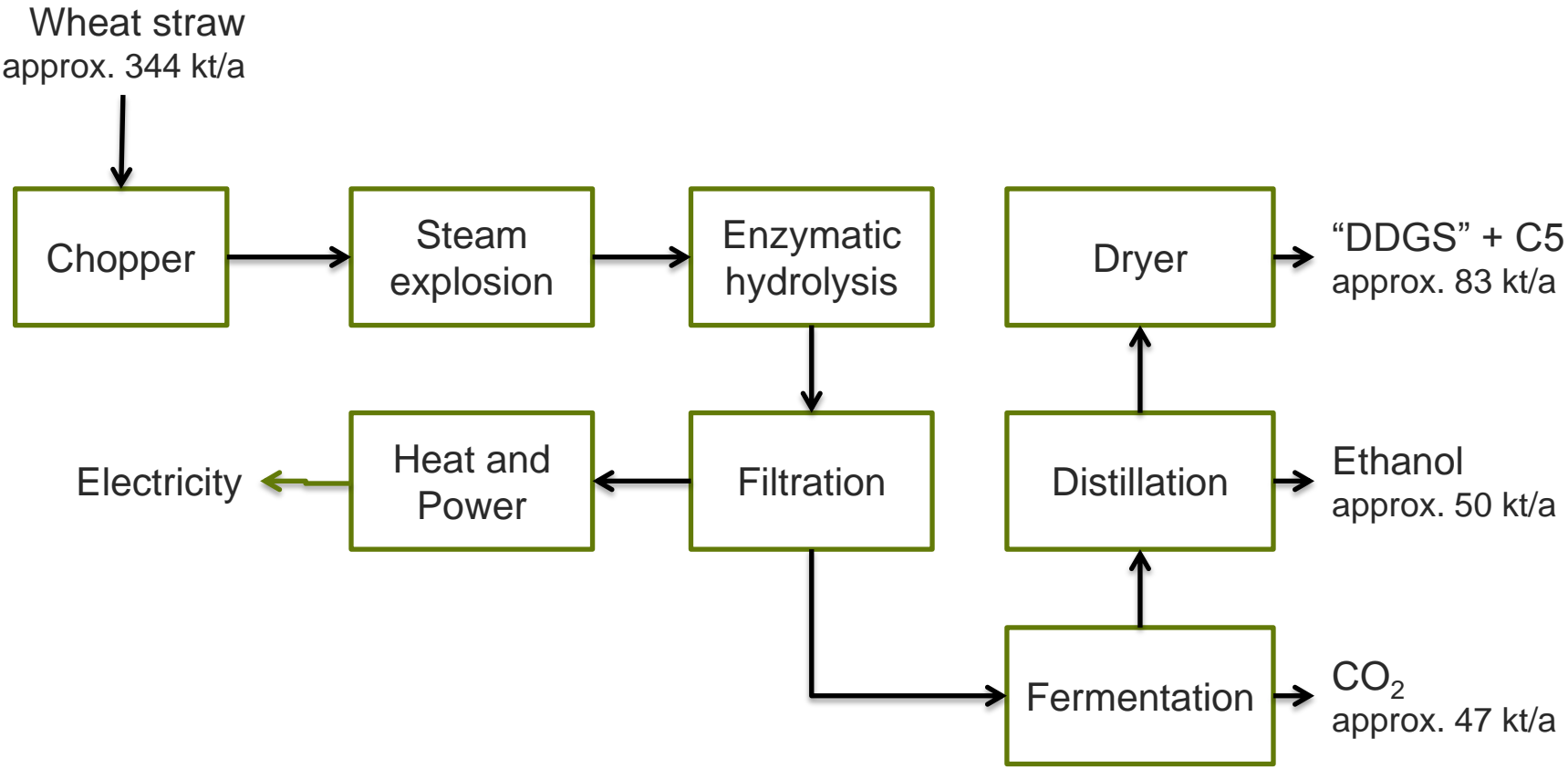
- Wheat grain
- separation of gluten and bran
- Mixing of bran into DDGS
- 100 kt/a ethanol

straw only

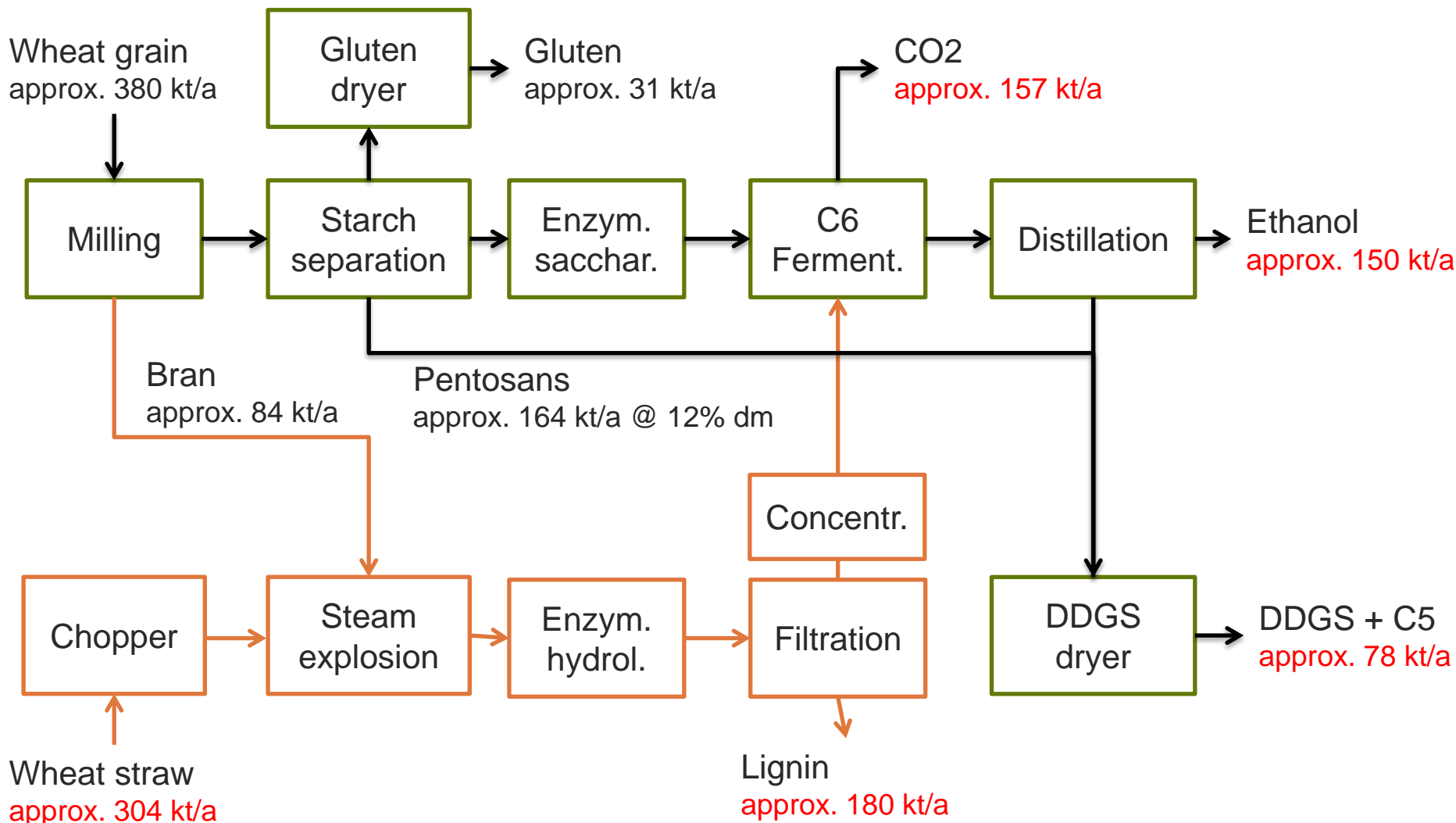
- Wheat straw
- Steam explosion
- Enzymatic hydrolysis
- C6-fermentation
- Lignin combustion
- 50 kt/a ethanol

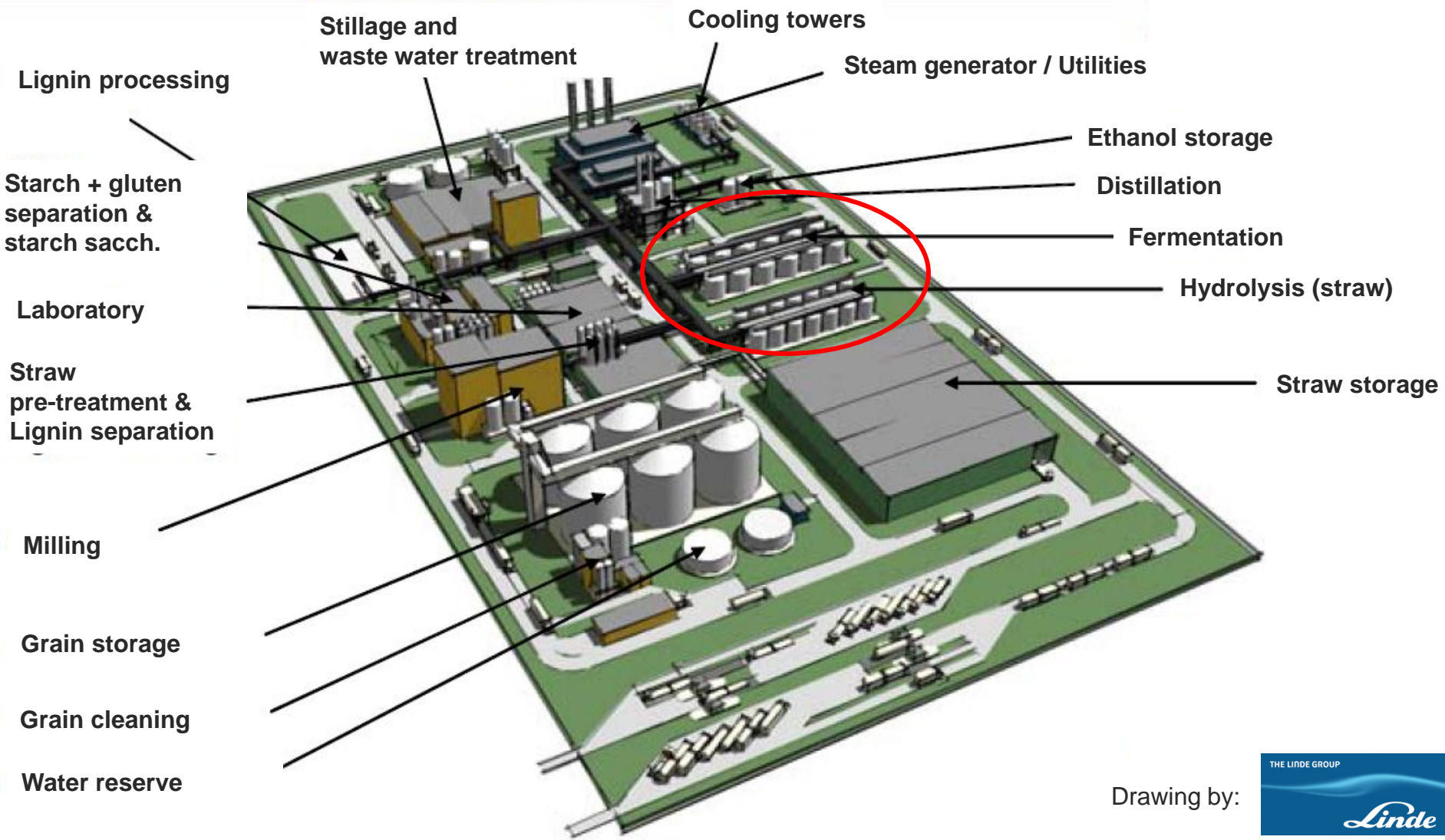
combinations

- Integration into wheat grain plant
- Separation of gluten and bran
- Bran → LC pretreatment
- 100 kt/a ethanol from starch
- 50 kt/a ethanol from LC



Basic biorefinery concept Wheat and Straw Ethanol (150 kt/a)





Drawing by:



Results from project partners could be integrated for the following process steps:

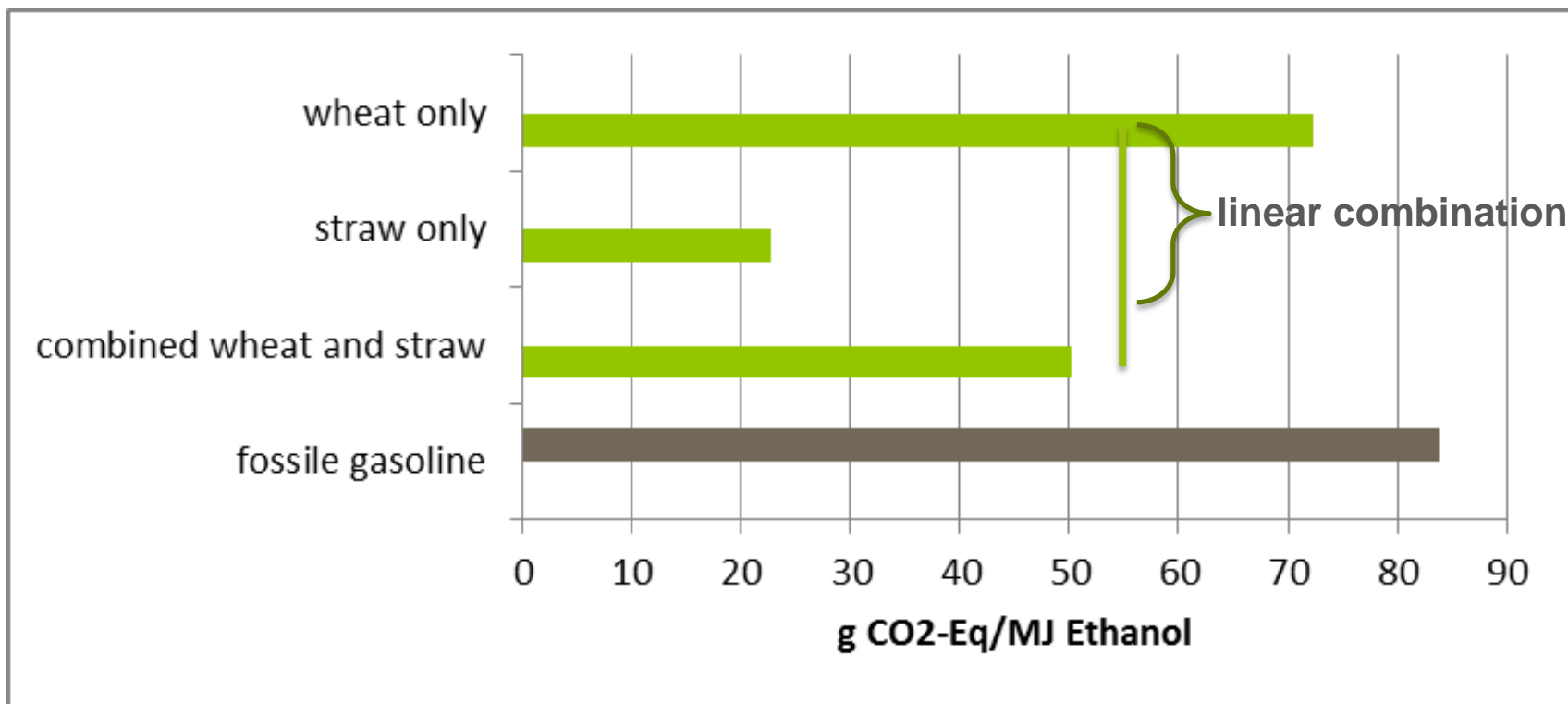
- Hot water hydrolysis as pretreatment method
- C5 sugar fermentation
- Biogas production from part of the stillage
- Marketing of part of the CO₂ in beverage sector

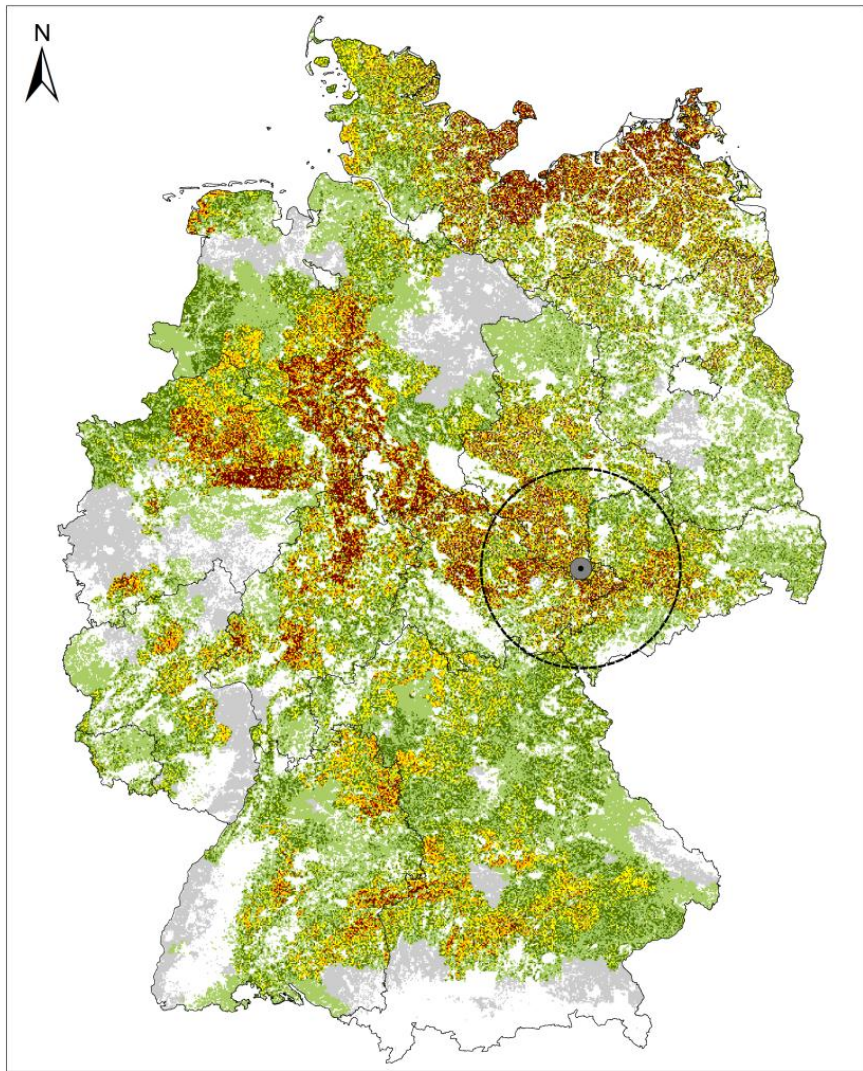
ASSESSMENT OF THE BIOREFINERIES

- Environmental Assessment
 - GHG Emissions
 - Energy demand
 - (Acidification and Eutrophication)

- Economic assessment
 - Investments were estimated (partly on the basis of quotations)
 - Straw logistics were thoroughly studied as a function of availability
 - All other raw material prices were gathered

- Calculation considering internal allocation
- Synergies can be seen by combining 1G and 2G processes

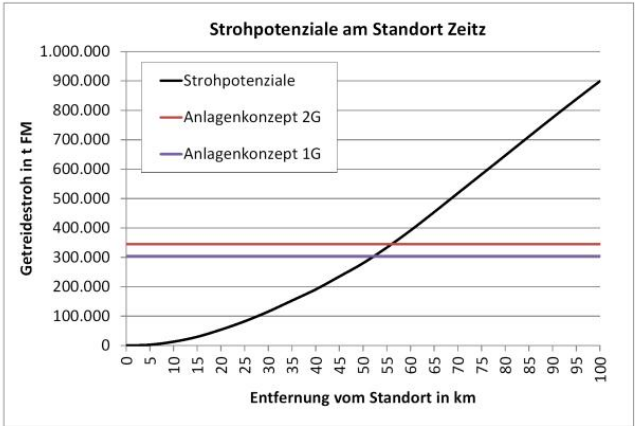




Sustainable straw potential in Germany (per km²)

Legende

- kein energetisch nutzbares Potenzial
- >0 - 25 t FM **(FM = dry matter)**
- >25 - 50 t FM
- >50 - 75 t FM
- >75 - 100 t FM
- >100 t FM
- Bundesland
- Standort Zeitz
- 100 km Einzugsgebiet

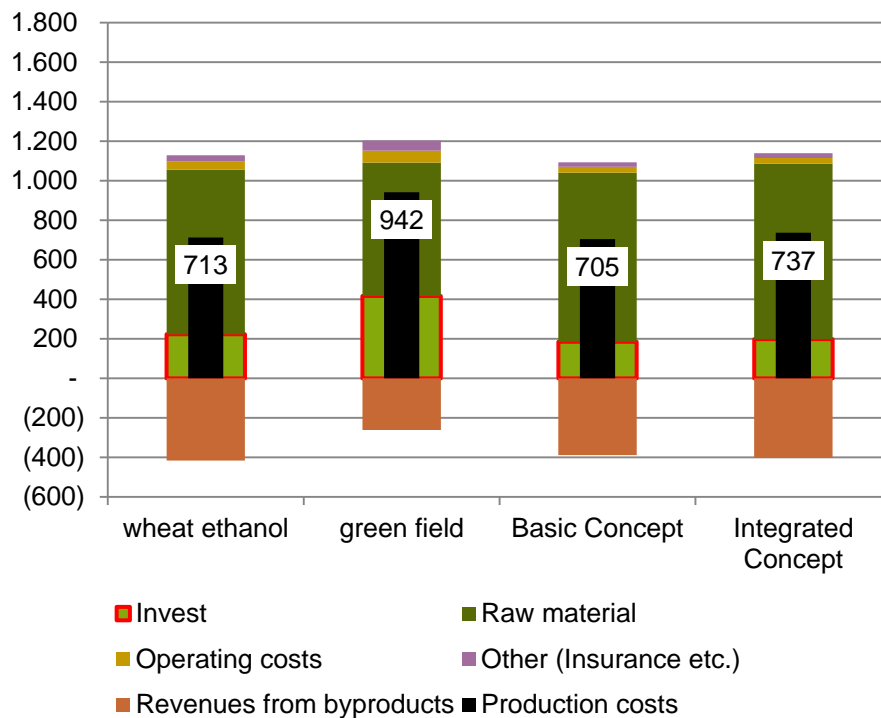


Geodatengrundlagen
ATKIS BasisDLM [BKG]
VG250 [BKG]

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		Prices
Rawmaterial		
	Straw	64 EUR/t
	Wheat	153 EUR/t
Utilities		
	Electricity	0,0971 EUR/kWh
	Natural gas	0,293 EUR/m ³
Products		
	Ethanol	578 EUR/m ³
	Gluten	1500 €/t
	Bran	205 EUR/t
	DDGS	201 €/t
	Lignin used as solid fuel	125 €/t

Production costs of Ethanol (€/m³)



- A number of interesting biorefinery concepts were developed
- High dry matter content throughout the process is highly important
- Straw only biorefineries show the best ghg-results
- Specific investment costs drop for combined processing concepts
- Economic feasibility depends on total utilization of feedstock
- Biorefinery concept will be further developed

I am happy to answer questions!
Estoy dispuesto para contestar preguntas!

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Who we are

DBFZ IN A NUTSHELL

- Research centre of the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV)
- Dedicated to research on bioenergy
- Established in 2008
- ≈ 200 employees
- ≈ 9 million EUR turnovers in 2010
- Research projects, funded mainly by public institutions but also by industry



Bioenergy Systems

- Potential analyses
- Bioenergy legislation monitoring
- Sustainability assessments

Biochemical Conversion

- Anaerobic fermentation
- Biogas for CHP
- Grid injection of biomethane

Thermochemical Conversion

- Household biomass combustion
- Emission prevention
- Pellet technology

Biorefineries

- Biorefinery concepts
- Liquid biofuels technology
- Synthetic natural gas technology